5. domain: $[-\sqrt{8}, \sqrt{8}]$

$y = x\sqrt{8-x^2} = x(8-x^2)^{1/2}$

$y' = x\cdot\frac{1}{2}(8-x^2)^{-\frac{1}{2}}(-2x) + (8-x^2)^{\frac{1}{2}}\cdot 1 = 0$

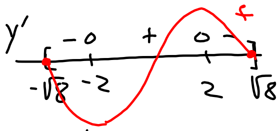
$y' = \frac{-x^2}{\sqrt{8-x^2}} + \frac{\sqrt{8-x^2}}{1}\cdot\frac{\sqrt{8-x^2}}{\sqrt{8-x^2}} = 0$

$y' = \frac{-x^2+8-x^2}{\sqrt{8-x^2}} = \frac{8-2x^2}{\sqrt{8-x^2}} = 0$

$\sqrt{8-x^2}=0$ $\qquad 8-2x^2=0$

$f' = *$ $\quad x=\sqrt{8}$ $\quad y=0$ $\qquad f'=0$ $\quad x=2$ $\quad y=4$ abs max

endpts $\quad x=-\sqrt{8}$ $\quad y=0$ $\qquad x=-2$ $\quad y=-4$ abs min



min at $x=-2$ because f' changes from − to +

max at $x=2$ because f' changes from + to −

Oct 12-9:10 AM

33. $y = 3x - x^3 + 5$

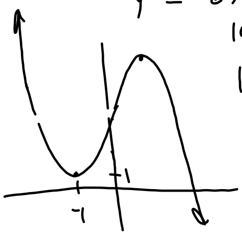
$y' = 3 - 3x^2 = 0$ $\quad$ max at $x=1$ $\quad y''=-6$

min at $x=-1$ $\quad y''=6$

$y'' = -6x$

local max is 7

local min is 1



Oct 12-9:28 AM

4.4a Modeling and Optimization

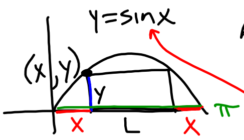
Strategy for solving max/min problems

1. Understand the problem.
2. Use pictures, label variables, constants. Find a function to model the problem.
3. Graph the function. Find the domain that makes sense
4. Find the critical points and endpoints . Plug em in
5. Use the first or second derivative test to identify maximums and minimums. (no end points) open interval
6. Answer the original question.

Oct 18-6:48 PM

A rectangle is to be inscribed under one arch of a sine curve. What is the largest area the rectangle can have, and what dimensions give that area?

1. guess and check with 4.4 rectangle under sine curve.tns



A = area

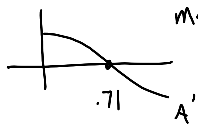
$A = L\cdot y = (\pi-2x)y$

$A = (\pi-2x)\sin x$

$x+L+x=\pi$ $\qquad A' = (\pi-2x)\cos x + \sin x\cdot(-2)$

$L=\pi-2x$ $\qquad 0=(\pi-2x)\cos x - 2\sin x$

max at $x=.71$ because A' changes from + to −

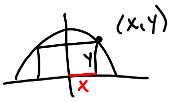


$y=0.652$

$L=1.722$

$A=1.122$

Oct 18-6:55 PM



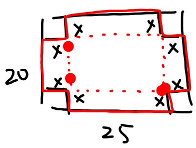
Oct 12-10:05 AM

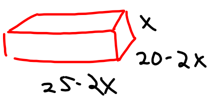
Solve using a derivative

Oct 18-7:13 PM

An open top box is to be made by cutting squares from the corners of a 20 by 25 inch sheet of cardboard and bending up the sides. What is the largest possible volume?

$0 < x < 10$





$V = l \cdot w \cdot h$

$V = (25-2x)(20-2x)x$

$V' = 12x^2 - 180x + 500 = 0$

max at $x = 3.681$

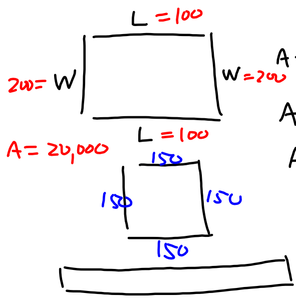
$\cancel{x = 11.319}$

$V'' = 24x - 180 \Big|_{x=3.681} < 0$

max $V = 820.5$ in^3

Oct 18-7:17 PM

What is the largest rectangular garden that can be enclosed with 600 feet of fence?



$A = L \cdot W$

$2L + 2W = 600$

$L + W = 300$

$L = 300 - W$

$A = (300 - W)W$

$A = 300W - W^2$

$A' = 300 - 2W = 0$

max at $W = 150$

$A'' = -2$

max A is 22,500 ft^2

Oct 18-7:20 PM